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AFPTEF PROJECT NO. 04-P-111

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Qualification Testing of the B-52 Nose Radome Container, CNU-680/E

HQ AFMC/LSO/LOP
AIR FORCE PACKAGING TECHNOLOGY & ENGINEERING FACILITY
WRIGHT PATTERSON AFB, OH 45433-5540
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AFPTEF PROJECT NO.: 04-P-111
TITLE: B-52 Nose Radome Container

ABSTRACT

The objective of this test series was to qualify the B-52 Nose Radome Shipping and Storage container, AFPTEF project number 04-P-111, for production release by AFMC LSO/LOP. The container is a sealed, reusable, aluminum container engineered for the physical and environmental protection of the B-52 Nose Radome during worldwide transportation and storage.

The test plan referenced SAE ARP 1967 and ASTM D 4169. All tests were performed at the Air Force Packaging Technology & Engineering Facility (AFPTEF), AFMC LSO/LOP, 5215 Thurlow St, Bldg 70, Wright-Patterson AFB OH 45433-5540.

Total Project Hours: 65

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TABLE OF CONTENTS

INTRODUCTION

BACKGROUND

The B-52 Logistics Management office located at Tinker AFB requested that the Air Force Packaging Technology and Engineering Facility (AFPTEF) develop a long-life aluminum container for the B-52 Nose Radome. This container is a replacement for the current packaging system consisting of a wood box which degrades readily in outdoor long-term storage and generally provides inadequate protection for the radome.

REQUIREMENTS

The container test plan (see Appendix 1) was developed for qualifying the container for worldwide transportation and storage.

DEVELOPMENT

DESIGN OF THE CONTAINER

The B-52 Nose Radome Shipping and Storage Container is a sealed, reusable, aluminum container engineered for the physical and environmental protection of the B-52 Nose Radome during worldwide transportation and storage. The container consists of a base and completely removable cover equipped with the special features listed below. A silicone rubber gasket and cam-over-center latches create a watertight seal at the base/lid interface.

An enclosed four-way forklift access aluminum base is welded to the container bottom. An aluminum cradle system is mounted on helical steel isolators, which in turn are mounted to the interior container sides. The isolators limit the transmission of shock to the radome to 50 Gs. A lifting frame attaches to the radome using four pins and two hook locks in the aft, and by two pins in the forward. The lifting frame and radome are then attached to the cradle system using four clamps. Container external dimensions are 135.2 inches length, 104.1 inches width, and 105.1 inches height. Container empty weight is 2402 pounds, and 2620 pounds with the radome in place.

RADOME CONTAINER FEATURES	
PRESSURE RELIEF VALVE	FIVE
HUMIDITY INDICATOR	ONE
DESICCANT PORT	TWO
DOCUMENT RECEPTACLE	NONE
FORKLIFTABLE	YES
COVER LATCHES	28
COVER LIFT HANDLES	NONE
COVER LIFT RINGS	ONE
COVER TETHER RINGS	FOUR
BASE LIFT HANDLES	NONE
BASE TIEDOWN RINGS	SIX
STACKING INTERFACE	NO

TESTING

TEST SPECIMEN
The test specimen was an aluminum container manufactured by AFPTEF.

TEST LOAD
The test load was an unserviceable, reparable, B-52 Nose Radome.

TEST PROCEDURES
The radome container was tested in accordance with the Air Force Packaging Technology & Engineering Facility (AFPTEF) modified long life container test plan (Appendix 1).

The test plan primary references were ASTM D 4169 and SAE ARP 1967. The test methods specified in this test plan constituted the procedure for performing the tests on the radome container. The performance criteria for evaluation of container acceptability were specified at 50 Gs maximum and an initial and final leak rate of 0.05 psi/hr at 1.0 psi. These tests are commonly applied to special shipping containers providing rough handling protection to sensitive items. The tests were performed at AFPTEF, AFMC LSO/LOP, 5215 Thurlow St, Wright-Patterson AFB, OH 45433-5540.

INSTRUMENTATION AND EQUIPMENT

CONTAINER FACE IDENTIFICATION
The correlation between container sides and container features for test purposes was as follows (See Appendix 3, Figure 5):

DESIGNATED SIDE	CONTAINER FEATURE	NUMBER
Top	Cover Top	1
Aft	Desiccant Port	4
Forward	Opposite Aft	2
Left	Left (Long) Side	6
Right	Right (Long) Side	5
Bottom	Base Bottom	3

ITEM INSTRUMENTATION
The test load was instrumented with a piezoelectric triaxial accelerometer mounted as close as possible to the radome's center of mass. Accelerometer positive axis orientations were as follows:

X Axis - Directed through container Top and Bottom (Vertical motion).
Y Axis - Directed through container Forward and Aft sides (Longitudinal motion).
Z Axis - Directed through container Left and Right sides (Transverse motion).

PRESSURE TEST EQUIPMENT - Test sequences 1 & 5

EQUIPMENT	MANUFACTURER	MODEL	SN	CAL. DATE
Digital Manometer	Yokogawa	2655	82DJ6009	June 05

ROUGH HANDLING TEST EQUIPMENT - Test sequences 2 & 4.

EQUIPMENT	MANUFACTURER	MODEL	SN	CAL. DATE
Shock Amplifier	Endevco	2775A	ER34	NA
Shock Amplifier	Endevco	2775A	ER33	NA
Shock Amplifier	Endevco	2775A	EL81	NA
Radome Accelerometer	Endevco	2223D	FL46	Sep 04
Radome Accelerometer	Endevco	2228C	16471	Dec 05
Data Acquisition	GHI Systems	CAT	Ver. 2.7.1	N/A

VIBRATION TEST EQUIPMENT - Test sequence 3.

EQUIPMENT	MANUFACTURER	MODEL	SN	CAL. DATE
Transportation Data Recorder	IST	EDR-3	9009280082	NA

For the vibration test only, the test load was instrumented with a second piezoelectric triaxial accelerometer, also mounted as close as possible to the radome's center of mass. Accelerometer positive axis orientations were as follows:

X Axis - Directed through container Forward and Aft sides (Longitudinal motion).
Y Axis - Directed through container Top and Bottom (Vertical motion).
Z Axis - Directed through container Left and Right sides (Transverse motion).

TEST SEQUENCES
Note: All test sequences were performed at ambient temperature and humidity.

TEST SEQUENCE 1 - SAE ARP 1967, para. 4.5.2 – Containers, Shipping & Storage, Reusable, Leak Test

The left desiccant port cover was removed and replaced with a port cover modified for attachment of the digital manometer and vacuum/pressure pump lines. The right desiccant port cover was replaced with a cover modified for attachment of a high-pressure air line. The container was closed and sealed. The leak test was conducted in accordance with the above specification, at ambient temperature and pressure. The pneumatic pressure leak technique was used to pressurize the container to a minimum test pressure of 1.0 psi (See Appendix 3, Figure 8).

TEST SEQUENCE 2 - SAE ARP 1967, para. 4.5.3 – Containers, Shipping & Storage, Reusable, ASTM D4169, Schedule A, para. 10.3.3.1(3), Assurance Level I – Rotational Drops (ASTM D6179, Methods A & B)

An Assurance Level I drop height of 12 in. was used to perform four corner and four edge drops onto a one-inch thick steel plate (See Appendix 3, Figures 9 and 10).

TEST SEQUENCE 3 - Over-the-Road Vehicle Vibration Test

Due to the container size, the standard vibration tests (SAE ARP 1967, para. 4.5., Vibration Test; and ASTM D4169, Schedule E, para. 12.5, Vehicle Vibration, Sine Test Option, Resonance Dwell) could not be performed on this prototype. Instead, an over-the-road vehicle vibration test, intended to duplicate real-world conditions as closely as possible, was performed. The container was placed on the wood deck of a tractor trailer, and held in place using cargo straps attached to the tie-down rings. (See Appendix 3, Figure 12).

The vibration and acceleration experienced by the radome were recorded for a period of 1.5 hours using an EDR-3 transportation environment data recorder. The container was transported over a variety of surfaces including: gravel; abandoned and broken asphalt paving (10 mph to 30 mph); concrete and asphalt interstate highway (55 mph), both newly-paved and several years old; 2-lane and 4-lane asphalt state highways (35 mph to 55 mph); and various 2-lane asphalt roads on Wright-Patterson AFB at speeds ranging from 10 mph to 45 mph (See Appendix 3, Figure 12).

TEST SEQUENCE 4 - SAE ARP 1967, para. 4.5.6 – Containers, Shipping & Storage, Reusable ASTM D4169, Schedule A, para. 10.3.3.1(4), Assurance Level I – Lateral Impacts (ASTM D880, Procedure A)

Upon completion of test sequence 3, the container was transported to Tinker AFB for a fit and function check. Upon its return, the loaded container was placed on the test apparatus and impacted. The container impact velocity was 2.13 m/sec. Only the aft and forward container sides could be impacted (one time each) due to the size limitations of the test apparatus (See Appendix 3, Figure 11).

TEST SEQUENCE 5 - SAE ARP 1967, para. 4.5.2 – Containers, Shipping & Storage, Reusable, Leak Test

The left desiccant port cover was removed and replaced with a port cover modified for attachment of the digital manometer and vacuum/pressure pump lines. The right desiccant port cover was replaced with a cover modified for attachment of a high-pressure air line. The container was closed and sealed. The leak test was conducted in accordance with the above specification, at ambient temperature and pressure. The pneumatic pressure leak technique was used to pressurize the container to a minimum test pressure of 1.0 psi. (See Appendix 3, Figure 8)

TEST RESULTS

Test Sequence 1 – Leak Test
The container passed the leak test with a leak rate less than the maximum allowed rate of 0.05 psi per hour.

Test Sequence 2 – Rough Handling: Rotational Drops
There was no noticeable damage to either the container or item. There was no flattening of clay placed on the radome at points where excessive swaying of the support frame might have allowed the radome to impact the container lid. The maximum recorded impacts, after filtering at 200 Hz to reduce excessive ringing (buzzing) from the cradle frame and radome, ranged from 18 Gs to 27 Gs, well below the item fragility of 50 Gs. Without filtering the G-levels remained below 35 Gs (See Test Data, Table 1 and Graphs 1 - 8). The container met the test requirements.

Test Sequence 3 – Over-the-Road Vibration Test. No accelerations greater than 5 Gs were recorded for any axis. The vibration recordings for the events with the highest G levels, as well as a sampling of other events, were observed; however there were no signs of increasing vibration amplitude or of anything else that would cause concern. The container met the test requirements (See Test Data, Table 2).

Test Sequences 4 – Rough Handling: Lateral Impacts
No noticeable damage occurred to the container or item. The item did not make contact with any interior container surfaces during testing. The maximum recorded impacts, after filtering at 200 Hz to compensate for excessive ringing, ranged from 11 Gs to approximately 20 Gs, all below the item fragility of 50 Gs. Without filtering the maximum G-levels ranged from 14 Gs to 30 Gs (See Test Data, Table 1 and Graph 9). Although the recorded data file for the aft side impact was not recorded, it is known to have been below 30 Gs without filtering. The container met the test requirements.

Test Sequence 5 – Leak Test
The container passed the leak test with a leak rate less than the maximum allowed rate of 0.05 psi.

PROJECT CONCLUSIONS

No damage occurred during the above testing to the container, mounting system or test item. There was no evidence of any contact from impacts between the radome and the container walls or lid. All impact levels are well below the item fragility limit of 50 Gs. Therefore, the container and mounting system do provide adequate protection for the radome.

TABLE 1. Impact Test Summary

IMPACT TYPE	TEST TEMPERATURE	IMPACT LOCATION	RESULTANT PEAK G
ROTATIONAL - CORNER	ambient	forward-left	21
ROTATIONAL - CORNER	ambient	forward-right	27
ROTATIONAL - CORNER	ambient	aft-left	18
ROTATIONAL - CORNER	ambient	aft-right	24
ROTATIONAL - EDGE	ambient	forward-bottom	23
ROTATIONAL - EDGE	ambient	aft-bottom	19
ROTATIONAL - EDGE	ambient	left-bottom	20
ROTATIONAL - EDGE	ambient	right-bottom	25
LATERAL IMPACT - FACE	ambient	forward	17
LATERAL IMPACT - FACE	ambient	aft*	*
LATERAL IMPACT - FACE	ambient	left	NA
LATERAL IMPACT - FACE	ambient	right	NA

* Test data not recorded; however, the resultant peak G for this impact is known to have been less than 30 Gs without filtering.

TABLE 2. Tabulated Vibration (Impact) Test Data.

Tue Aug 23 12:54:23 2005 Tabulated Impact Report page 0001

File: B52 RADM
Sorted by: Time
Total events: 200
Table of: Acceleration waveforms
Report Subject: B5 Radome
Over-the-Road Vibration/Impact Test.

X: FOA
Y: vert
Z: trans

EV #		time	Max X g	Max Y g	Max Z g
1	00	08/23/105 09:24:25	1.231	1.057	0.880
2	00	08/23/105 09:24:33	2.556	2.017	1.466
3	00	08/23/105 09:24:42	1.420	1.441	1.075
4	00	08/23/105 09:24:51	0.852	1.057	0.684
5	00	08/23/105 09:24:59	1.041	1.057	0.489
6	00	08/23/105 09:25:08	1.041	1.057	0.684
7	00	08/23/105 09:25:16	1.231	1.249	0.880
8	00	08/23/105 09:25:24	1.609	1.633	0.880
9	00	08/23/105 09:26:16	1.420	1.441	1.857
10	00	08/23/105 09:26:24	1.420	2.017	2.053
11	00	08/23/105 09:32:05	1.041	1.825	1.075
12	00	08/23/105 09:32:14	1.231	1.057	0.880
13	00	08/23/105 09:32:23	1.041	1.441	1.662
14	00	08/23/105 09:32:31	1.041	1.057	0.684
15	00	08/23/105 09:32:40	1.420	1.441	2.053
16	00	08/23/105 09:33:14	1.041	1.249	0.684
17	00	08/23/105 09:33:31	2.367	2.401	3.030
18	00	08/23/105 09:33:40	1.231	1.633	0.880
19	00	08/23/105 09:33:49	1.231	1.825	1.075
20	00	08/23/105 09:33:57	1.420	1.633	2.835
21	00	08/23/105 09:34:06	1.799	1.633	2.248
22	00	08/23/105 09:34:15	1.231	1.441	1.662
23	00	08/23/105 09:34:23	2.177	2.209	1.857
24	00	08/23/105 09:34:49	1.420	1.441	1.271
25	00	08/23/105 09:34:57	1.231	1.249	0.880
26	00	08/23/105 09:35:06	1.231	1.825	1.662
27	00	08/23/105 09:35:15	1.420	1.825	2.248
28	00	08/23/105 09:35:32	1.231	1.441	2.053
29	00	08/23/105 09:35:40	2.177	2.209	2.053
30	00	08/23/105 09:35:49	1.420	1.633	2.248
31	00	08/23/105 09:35:57	1.420	1.825	1.466
32	00	08/23/105 09:36:06	1.420	1.441	1.466
33	00	08/23/105 09:36:14	2.745	2.017	1.466
34	00	08/23/105 09:36:23	1.799	1.633	1.662
35	00	08/23/105 09:36:31	5.775	4.706	3.421
36	00	08/23/105 09:36:40	3.124	2.593	3.030
37	00	08/23/105 09:36:48	1.609	2.017	1.662
38	00	08/23/105 09:36:57	1.420	1.825	2.053
39	00	08/23/105 09:37:23	1.231	1.441	1.662
40	00	08/23/105 09:37:31	2.177	1.825	2.248
41	00	08/23/105 09:37:40	1.799	2.209	2.444
42	00	08/23/105 09:37:48	2.367	2.209	2.444
43	00	08/23/105 09:37:57	1.799	1.825	4.203
44	00	08/23/105 09:38:05	2.177	1.825	2.053
45	00	08/23/105 09:38:14	1.420	1.633	1.857
46	00	08/23/105 09:38:57	1.231	1.249	0.880

TABLE 2. Tabulated Vibration (Impact) Test Data (Continued).

Tue Aug 23 12:54:23 2005 Tabulated Impact Report page 0002

EV #		time	Max X g	Max Y g	Max Z g
47	00	08/23/105 09:39:14	1.231	1.441	2.248
48	00	08/23/105 09:39:23	1.231	1.441	1.271
49	00	08/23/105 09:40:05	1.799	2.017	2.444
50	00	08/23/105 09:40:14	1.609	1.441	1.662
51	00	08/23/105 09:42:47	1.799	1.057	1.662
52	00	08/23/105 09:43:04	1.231	1.057	1.075
53	00	08/23/105 09:43:13	1.231	1.249	1.075
54	00	08/23/105 09:43:30	1.041	2.017	1.271
55	00	08/23/105 09:43:38	1.420	1.441	1.662
56	00	08/23/105 09:43:47	1.799	2.593	2.639
57	00	08/23/105 09:43:55	1.041	1.057	0.880
58	00	08/23/105 09:44:04	2.556	2.593	2.444
59	00	08/23/105 09:45:46	1.420	1.441	1.271
60	00	08/23/105 09:45:55	1.609	2.209	1.466
61	00	08/23/105 09:46:20	1.799	1.441	1.662
62	00	08/23/105 09:46:37	1.420	1.057	0.880
63	00	08/23/105 09:46:46	1.420	1.057	0.880
64	00	08/23/105 09:46:54	2.556	2.401	2.053
65	00	08/23/105 09:47:11	1.988	1.441	0.880
66	00	08/23/105 09:47:20	1.420	1.441	1.662
67	00	08/23/105 09:48:36	1.041	0.864	1.466
68	00	08/23/105 09:50:02	1.609	2.017	1.662
69	00	08/23/105 09:50:19	1.420	1.249	1.662
70	00	08/23/105 09:50:27	1.231	0.672	1.466
71	00	08/23/105 09:51:02	1.799	1.441	1.857
72	00	08/23/105 09:52:10	1.420	1.249	1.466
73	00	08/23/105 09:55:52	2.177	1.825	1.857
74	00	08/23/105 09:56:00	1.231	1.057	0.880
75	00	08/23/105 09:56:17	1.231	1.057	1.075
76	00	08/23/105 09:56:25	2.935	2.593	2.639
77	00	08/23/105 09:56:51	1.231	1.249	1.075
78	00	08/23/105 09:57:00	1.420	2.209	2.248
79	00	08/23/105 09:57:08	1.420	1.441	2.053
80	00	08/23/105 09:57:42	1.041	0.864	0.880
81	00	08/23/105 09:57:51	2.177	2.209	3.030
82	00	08/23/105 09:58:51	1.231	0.864	0.684
83	00	08/23/105 09:59:08	1.231	1.633	1.271
84	00	08/23/105 09:59:33	1.231	0.864	1.466
85	00	08/23/105 09:59:42	0.852	0.672	0.880
86	00	08/23/105 09:59:51	1.988	2.209	3.030
87	00	08/23/105 09:59:59	1.420	2.017	2.053
88	00	08/23/105 10:01:16	1.420	1.441	1.075
89	00	08/23/105 10:01:42	1.420	1.441	2.248
90	00	08/23/105 10:01:50	1.799	1.825	1.857
91	00	08/23/105 10:02:24	1.041	1.057	0.684
92	00	08/23/105 10:03:49	1.231	1.057	1.466
93	00	08/23/105 10:03:58	1.420	1.441	1.466
94	00	08/23/105 10:06:48	1.799	1.633	1.271
95	00	08/23/105 10:08:30	1.799	2.017	2.444
96	00	08/23/105 10:13:28	1.041	0.864	0.684
97	00	08/23/105 10:13:36	1.231	0.672	0.684
98	00	08/23/105 10:13:45	1.231	0.672	0.880
99	00	08/23/105 10:14:02	1.231	1.249	0.880
100	00	08/23/105 10:15:01	1.231	1.249	0.880

TABLE 2. Tabulated Vibration (Impact) Test Data (Continued).

Tue Aug 23 12:54:23 2005 Tabulated Impact Report page 0003

EV #		time	Max X g	Max Y g	Max Z g
101	00	08/23/105 10:15:10	1.041	1.057	0.880
102	00	08/23/105 10:17:01	1.609	2.017	2.444
103	00	08/23/105 10:17:52	1.041	0.864	0.880
104	00	08/23/105 10:18:09	1.609	1.441	2.053
105	00	08/23/105 10:22:58	1.231	1.249	0.880
106	00	08/23/105 10:23:49	1.609	1.825	2.248
107	00	08/23/105 10:23:57	1.041	1.057	1.271
108	00	08/23/105 10:24:14	1.041	1.249	1.466
109	00	08/23/105 10:24:23	1.231	1.057	0.880
110	00	08/23/105 10:24:31	1.988	1.825	2.248
111	00	08/23/105 10:24:40	1.231	1.441	1.075
112	00	08/23/105 10:25:05	1.041	1.057	1.271
113	00	08/23/105 10:25:23	1.041	1.249	1.466
114	00	08/23/105 10:25:40	1.231	0.864	1.662
115	00	08/23/105 10:25:57	1.041	0.864	1.075
116	00	08/23/105 10:26:14	1.799	1.633	1.662
117	00	08/23/105 10:26:22	1.231	1.825	2.053
118	00	08/23/105 10:26:56	1.231	0.864	0.880
119	00	08/23/105 10:28:04	1.231	1.441	1.271
120	00	08/23/105 10:28:30	1.231	1.249	1.075
121	00	08/23/105 10:29:21	1.420	1.249	0.880
122	00	08/23/105 10:29:46	1.420	0.864	1.662
123	00	08/23/105 10:31:37	2.367	2.401	2.639
124	00	08/23/105 10:31:45	1.420	1.441	1.075
125	00	08/23/105 10:31:54	1.231	0.864	0.880
126	00	08/23/105 10:32:11	1.609	1.441	1.271
127	00	08/23/105 10:32:19	1.609	2.017	2.053
128	00	08/23/105 10:32:45	1.420	1.441	1.271
129	00	08/23/105 10:32:53	1.231	1.249	0.880
130	00	08/23/105 10:33:02	1.041	1.249	1.271
131	00	08/23/105 10:33:10	2.177	2.401	2.639
132	00	08/23/105 10:33:27	2.745	2.785	3.421
133	00	08/23/105 10:34:10	1.041	1.249	0.684
134	00	08/23/105 10:36:34	1.799	1.441	1.271
135	00	08/23/105 10:36:43	1.609	2.017	1.271
136	00	08/23/105 10:36:51	1.799	1.441	1.271
137	00	08/23/105 10:37:00	1.799	2.017	1.662
138	00	08/23/105 10:37:08	2.556	1.633	1.466
139	00	08/23/105 10:37:17	1.799	1.249	1.662
140	00	08/23/105 10:38:25	1.231	0.864	0.880
141	00	08/23/105 10:38:33	2.367	2.209	2.248
142	00	08/23/105 10:40:15	1.420	1.825	1.662
143	00	08/23/105 10:40:49	1.799	1.633	2.248
144	00	08/23/105 10:40:58	1.041	1.441	1.662
145	00	08/23/105 10:41:15	1.041	0.864	0.880
146	00	08/23/105 10:41:23	1.041	0.864	1.271
147	00	08/23/105 10:41:32	1.041	0.864	1.075
148	00	08/23/105 10:41:58	1.420	1.057	1.662
149	00	08/23/105 10:42:06	1.231	1.825	2.053
150	00	08/23/105 10:42:32	1.231	1.057	0.684
151	00	08/23/105 10:42:40	1.231	0.864	1.466
152	00	08/23/105 10:44:13	2.556	2.785	3.421
153	00	08/23/105 10:45:13	1.420	1.825	2.053
154	00	08/23/105 10:50:54	1.420	1.633	1.857

TABLE 2. Tabulated Vibration (Impact) Test Data (Continued).

Tue Aug 23 12:54:23 2005 Tabulated Impact Report page 0004

EV #		time	Max X g	Max Y g	Max Z g
155	00	08/23/105 10:51:03	1.231	1.249	0.880
156	00	08/23/105 10:51:11	1.231	1.249	1.075
157	00	08/23/105 10:51:28	1.231	1.249	1.075
158	00	08/23/105 10:51:37	1.041	1.249	0.880
159	00	08/23/105 10:51:45	1.799	2.209	2.835
160	00	08/23/105 10:52:36	1.420	1.633	3.030
161	00	08/23/105 10:52:53	1.041	1.057	1.075
162	00	08/23/105 10:53:36	1.231	1.057	1.075
163	00	08/23/105 10:53:44	1.231	1.057	0.880
164	00	08/23/105 10:54:27	1.041	1.441	1.271
165	00	08/23/105 10:55:26	1.420	1.633	1.075
166	00	08/23/105 10:55:35	1.799	1.825	1.662
167	00	08/23/105 10:55:43	1.609	1.825	1.466
168	00	08/23/105 10:56:09	1.988	1.825	1.662
169	00	08/23/105 10:56:51	1.041	1.057	0.880
170	00	08/23/105 10:57:51	1.420	1.249	1.466
171	00	08/23/105 10:58:59	1.041	0.864	0.880
172	00	08/23/105 10:59:07	1.231	1.057	1.075
173	00	08/23/105 10:59:16	1.041	1.633	1.662
174	00	08/23/105 10:59:24	1.799	1.633	1.466
175	00	08/23/105 10:59:50	1.041	1.057	1.075
176	00	08/23/105 10:59:58	1.041	0.864	0.684
177	00	08/23/105 11:00:07	1.041	1.057	0.880
178	00	08/23/105 11:00:16	1.041	1.057	1.857
179	00	08/23/105 11:00:24	1.231	1.441	1.662
180	00	08/23/105 11:00:33	1.799	0.864	0.880
181	00	08/23/105 11:00:41	1.041	0.864	0.880
182	00	08/23/105 11:01:15	1.041	1.057	0.684
183	00	08/23/105 11:01:24	1.231	1.249	1.271
184	00	08/23/105 11:01:32	1.799	1.249	2.053
185	00	08/23/105 11:01:49	2.177	2.017	2.639
186	00	08/23/105 11:04:22	1.231	1.057	0.880
187	00	08/23/105 11:04:31	1.231	1.249	1.075
188	00	08/23/105 11:04:39	1.988	2.401	1.857
189	00	08/23/105 11:04:48	2.177	2.401	1.857
190	00	08/23/105 11:04:56	1.231	1.249	1.271
191	00	08/23/105 11:05:05	2.556	2.785	2.835
192	00	08/23/105 11:05:13	1.231	1.249	1.466
193	00	08/23/105 11:05:22	1.420	1.441	1.271
194	00	08/23/105 11:07:04	1.231	0.864	1.662
195	00	08/23/105 11:08:54	1.420	1.441	1.857
196	00	08/23/105 11:09:37	1.420	1.249	0.880
197	00	08/23/105 11:09:45	1.420	1.633	1.857
198	00	08/23/105 11:10:53	1.231	0.864	1.271
199	00	08/23/105 11:12:02	1.420	1.249	1.466
200	00	08/23/105 11:29:58	0.284	0.096	0.293

	Max X	Max Y	Max Z
MAX:	5.775	4.706	4.203
MIN:	0.284	0.096	0.293
MEAN:	1.494	1.489	1.536
SDEV:	0.537	0.538	0.669

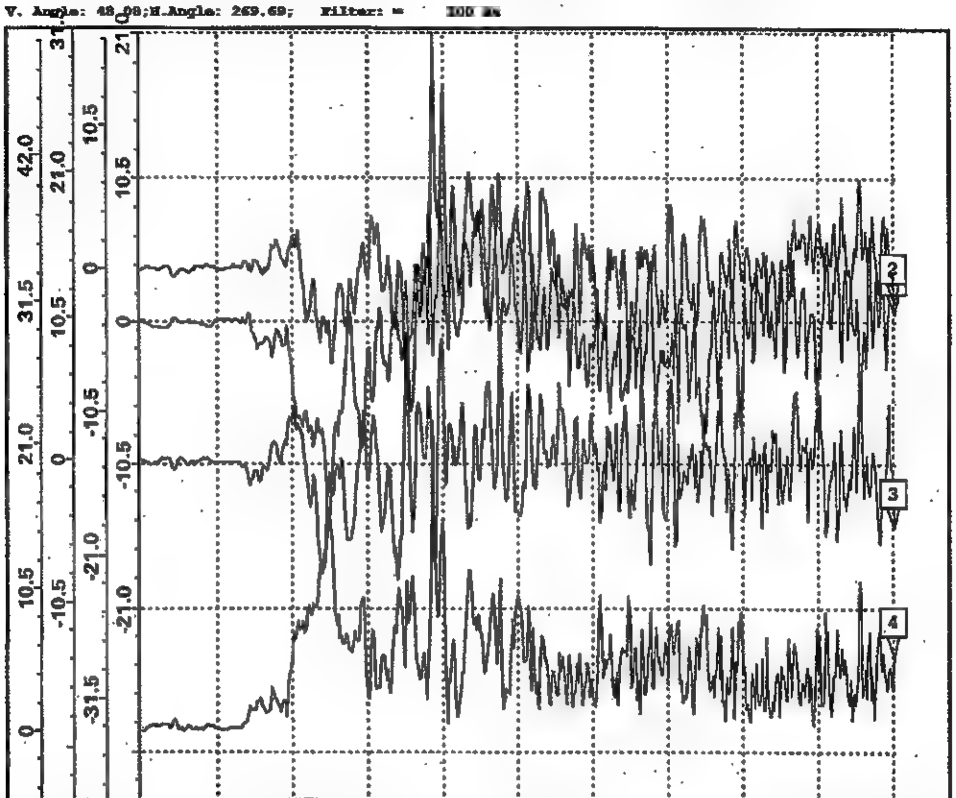
GRAPH 1

B-52 RADOME

ROTATIONAL DROP TEST

	Aug 18 2005 13:51	Test Engineer :	Evans
Test type :	Edgewise Drop	Impact Point :	Forward edge
Container/Item:	Aluminum/radome	Drop Height :	12 inches

V. Angle: 48.08;H.Angle: 269.69; Filter: = 100 Hz



	Ch.	Time		Curr Amp	Peak Amp	1st Int	Time/Div		Hexp	Vexp
○	1	237.	mS	4.93 g's	21.11 g's	-69.73 In/s	26	mS	1	2
○	2	237.	mS	-0.03 g's	13.40 g's	-29.91 In/s	26	mS	1	2
○	3	237.	mS	-5.49 g's	9.74 g's	-15.90 In/s	26	mS	1	2
◉	R	237.	mS	7.38 g's	23.02 g's	77.52 In/s	26	mS	1	2

PEAK G RESULTANT: 23 Gs. PEAK G(X): 21 Gs. 200Hz filter.

ACCELEROMETER OUTPUT: Ch1 = X(vert.); Ch2 = Y(long.); Ch3 = Z(trans.)
Ch4 = Resultant.
Aft side = desiccant port end.
Ambient temperature _humidity.
ASTM D 4169, ASTM D 6179. SAE ARP1967.

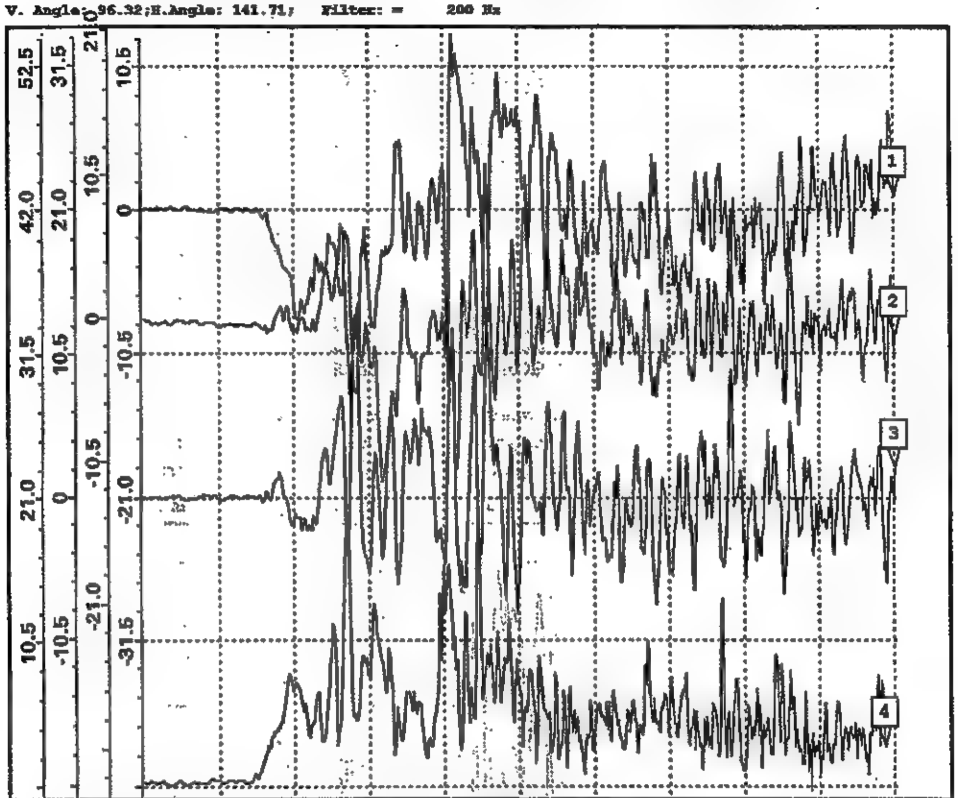
GRAPH 2

B-52 RADOME

ROTATIONAL DROP TEST

	Aug 18 2005 13:57	Test Engineer :	[redacted]
Test type :	Cornerwise Drop	Impact Point :	Forward-left corner
Container/Item:	Aluminum/radome	Drop Height :	12 inches

V. Angle: 96.32;H.Angle: 141.71; Filter: = 200 Hz



	Ch.	Time		Curr Amp	Peak Amp	1st Int	Time/Div		Hexp	Vexp
○	1	231.	mS	-0.20 g's	-13.71 g's	-67.18 In/s	26	mS	1	2
○	2	231.	mS	-1.40 g's	-11.98 g's	-67.15 In/s	26	mS	1	2
○	3	231.	mS	1.11 g's	14.08 g's	13.79 In/s	26	mS	1	2
●	R	231.	mS	1.17 g's	20.74 g's	95.99 In/s	26	mS	1	2

PEAK g RESULTANT: 21 Gs. PEAK G(Z): 14Gs. 200Hz filter.

ACCELEROMETER OUTPUT: Ch1 = X(vert.); Ch2 = Y(long.); Ch3 = Z(trans.)
Ch4 = Resultant.
Aft side = desiccant port end.
Ambient temperature _humidity.
ASTM D 4169, ASTM D 6179. SAE ARP1967.

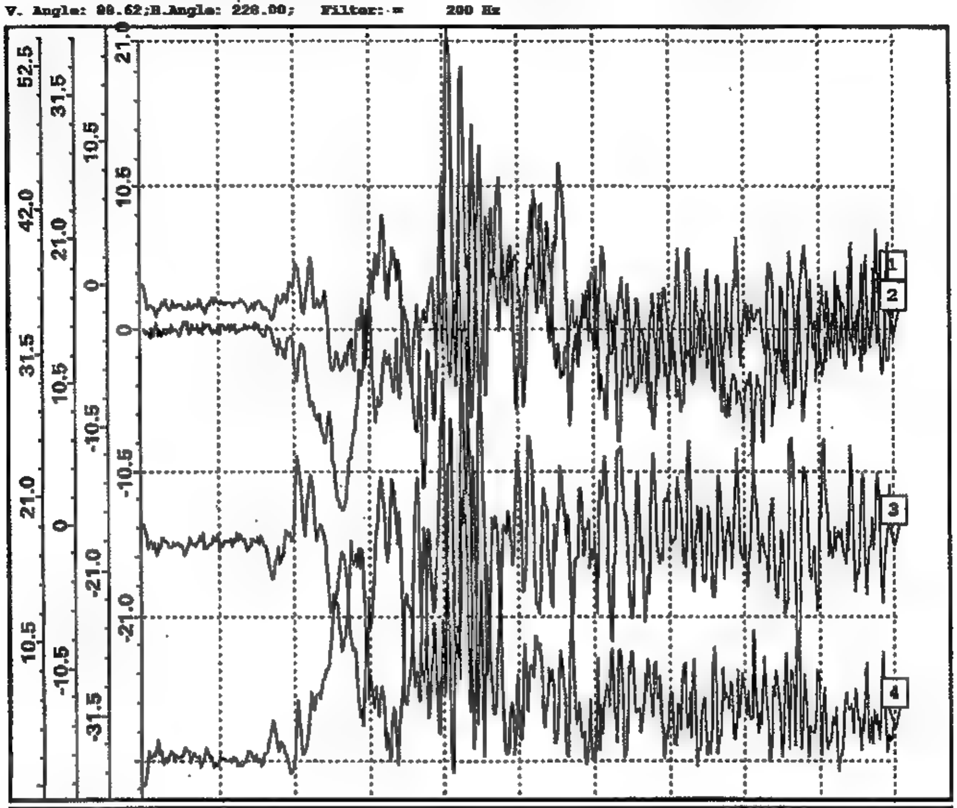
GRAPH 3

B-52 RADOME

ROTATIONAL DROP TEST

	Aug 18 2005 14:00	Test Engineer	:	Evans
Test type :	Cornerwise Drop	Impact Point	:	Forward-right corner
Container/Item:	Aluminum/radome	Drop Height	:	12 inches

V. Angle: 98.62;H.Angle: 228.00; Filter: = 200 Hz



Ch.	Time		Curr Amp	Peak Amp	1st Int	Time/Div		Hexp	Vexp
1	233.	mS	0.20 g's	22.31 g's	-99.82 In/s	26	mS	1	2
2	233.	mS	-5.61 g's	16.95 g's	-157.59 In/s	26	mS	1	2
3	233.	mS	-6.23 g's	-18.71 g's	-132.71 In/s	26	mS	1	2
R	233.	mS	8.39 g's	26.79 g's	228.93 In/s	26	mS	1	2

PEAK G RESULTANT: 27 Gs. PEAK G(X): 23 Gs. 200 Hz filter.

ACCELEROMETER OUTPUT: Ch1 = X(vert.); Ch2 = Y(long.); Ch3 = Z(trans.)
Ch4 = Resultant.
Aft side = desiccant port end.
Ambient temperature _humidity.
ASTM D 4169, ASTM D 6179. SAE ARP1967.

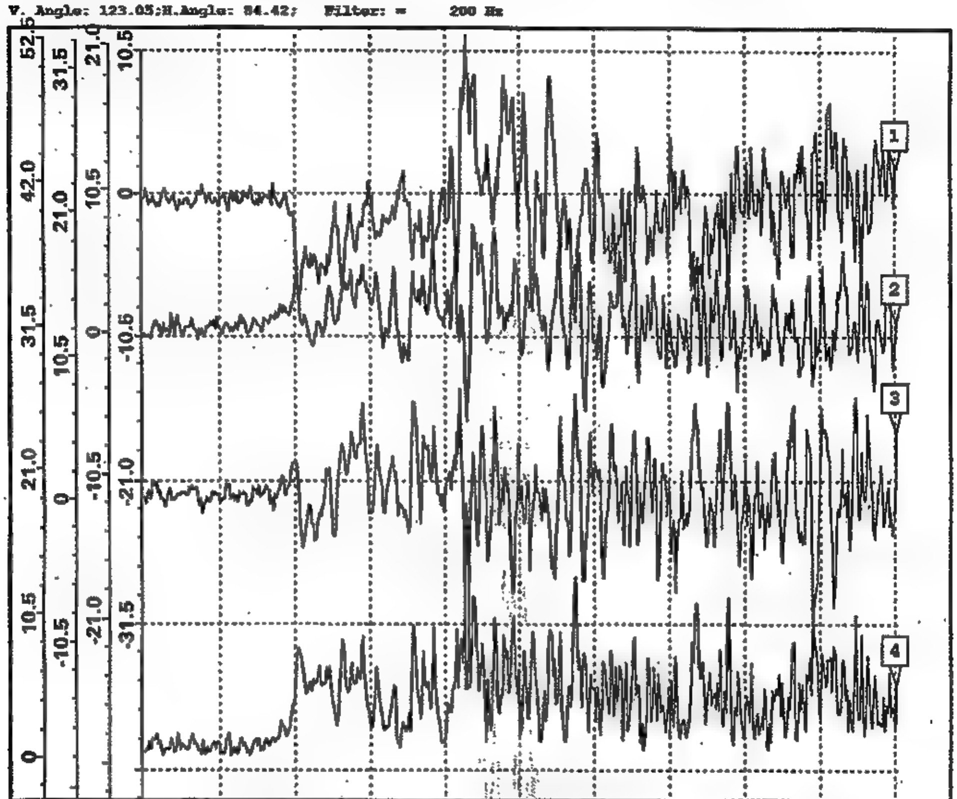
GRAPH 4

B-52 RADOME

ROTATIONAL DROP TEST

	Aug 18 2005 14:04	Test Engineer	:	Evans
Test type :	Edgewise Drop	Impact Point	:	Aft edge
Container/Item:	Aluminum/radome	Drop Height	:	12 inches

V. Angle: 123.05;H.Angle: 84.42; Filter: = 200 Hz



	Ch.	Time		Curr Amp	Peak Amp	1st Int	Time/Div		Hexp	Vexp
○	1	247.	mS	-4.84 g's	11.68 g's	-85.44 In/s	26	mS	1	2
○	2	247.	mS	0.72 g's	8.41 g's	98.46 In/s	26	mS	1	2
○	3	247.	mS	7.40 g's	-14.14 g's	38.27 In/s	26	mS	1	2
◉	R	247.	mS	8.88 g's	18.53 g's	135.86 In/s	26	mS	1	2

PEAK G RESULTANT: 19 Gs. PEAK G(Z): 14 Gs. 200 Hz filter.

ACCELEROMETER OUTPUT: Ch1 = X(vert.); Ch2 = Y(long.); Ch3 = Z(trans.)
Ch4 = Resultant.
Aft side = desiccant port end.
Ambient temperature _humidity.
ASTM D 4169, ASTM D 6179. SAE ARP1967.

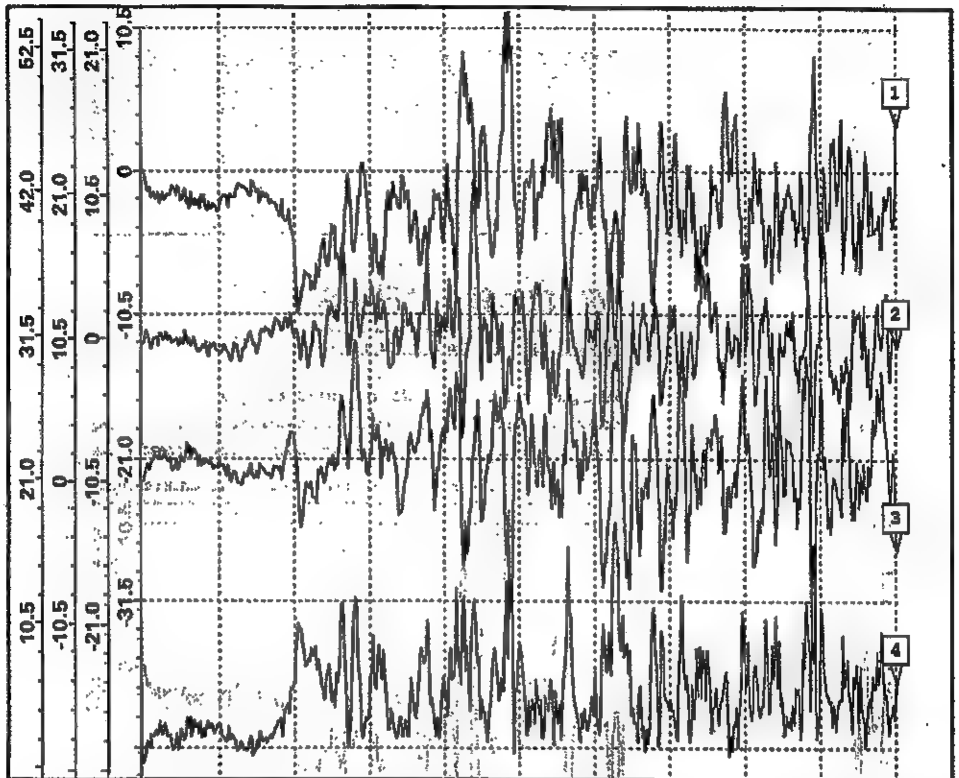
GRAPH 5

B-52 RADOME

ROTATIONAL DROP TEST

	Aug 18 2005 14:12	Test Engineer :	Evans
Test type :	Cornerwise Drop	Impact Point :	Aft-left corner
Container/Item:	Aluminum/radome	Drop Height :	12 inches

V. Angle: 159.12;H.Angle: 17.27; Filter: = 200 Hz



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	247. mS	-4.60 g's	-13.31 g's	-228.59 In/s	26 mS	1	2
2	247. mS	1.67 g's	11.64 g's	26.77 In/s	26 mS	1	2
3	247. mS	0.52 g's	-13.20 g's	122.41 In/s	26 mS	1	2
R	247. mS	4.92 g's	17.72 g's	260.68 In/s	26 mS	1	2

PEAK G RESULTANT: 18 Gs. PEAK G(Z): 13 Gs. 200 Hz filter.

ACCELEROMETER OUTPUT: Ch1 = X(vert.); Ch2 = Y(long.); Ch3 = Z(trans.)
Ch4 = Resultant.
Aft side = desiccant port end.
Ambient temperature _humidity.
ASTM D 4169, ASTM D 6179. SAE ARP1967.

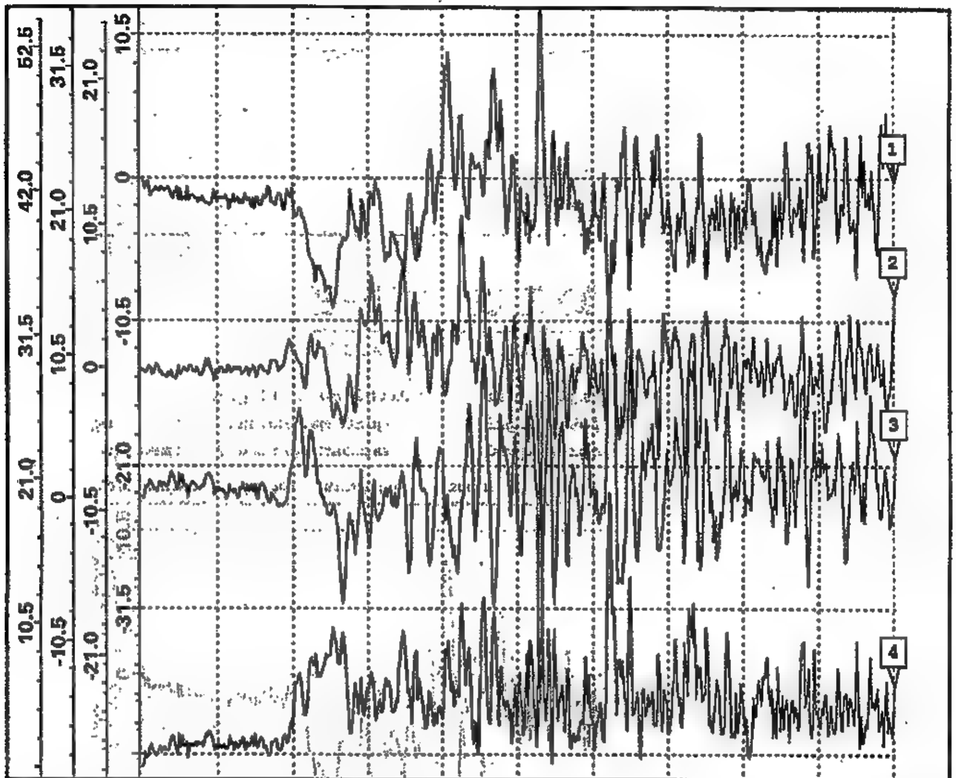
GRAPH 6

B-52 RADOME

ROTATIONAL DROP TEST

	Aug 18 2005 14:10	Test Engineer :	Evans
Test type :	Cornerwise Drop	Impact Point :	Aft-right corner
Container/Item:	Aluminum/radome	Drop Height :	12 inches

V. Angle: 105.33;H.Angle: 83.60; Filter: = 200 Hz



Ch.	Time		Curr Amp	Peak Amp	1st Int	Time/Div		Hexp	Vexp
1	228.	mS	-2.08 g's	14.01 g's	-176.45 In/s	26	mS	1	2
2	228.	mS	0.85 g's	-11.73 g's	28.40 In/s	26	mS	1	2
3	228.	mS	7.54 g's	17.14 g's	62.87 In/s	26	mS	1	2
R	228.	mS	7.86 g's	23.74 g's	189.46 In/s	26	mS	1	2

PEAK G RESULTANT: 24 Gs. PEAK G(Z): 17 Gs. 200 Hz filter.

ACCELEROMETER OUTPUT: Ch1 = X(vert.); Ch2 = Y(long.); Ch3 = Z(trans.)
Ch4 = Resultant.
Aft side = desiccant port end.
Ambient temperature _humidity.
ASTM D 4169, ASTM D 6179. SAE ARP1967.

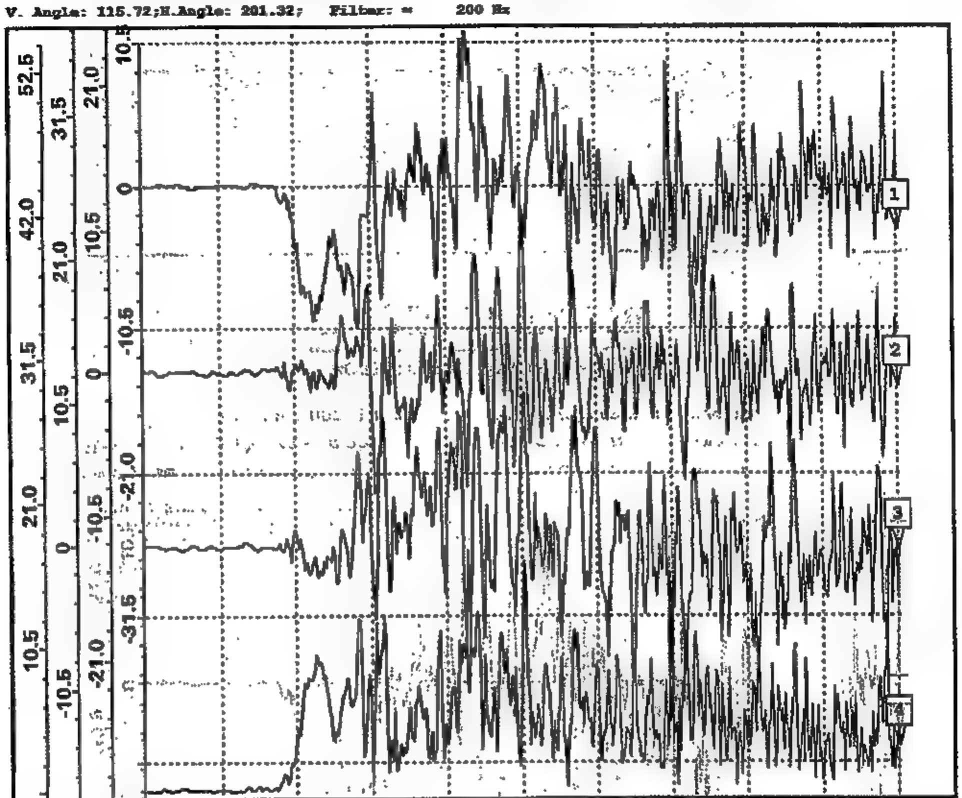
GRAPH 7

B-52 RADOME

ROTATIONAL DROP TEST

	Aug 18 2005 14:37	Test Engineer :	Evans
Test type :	Edgewise Drop	Impact Point :	Left edge
Container/Item:	Aluminum/radome	Drop Height :	12 inches

V. Angle: 115.72;H.Angle: 201.32; Filter: = 200 Hz



	Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
◉	1	228. mS	-1.02 g's	11.81 g's	-70.11 In/s	26 mS		2
○	2	228. mS	-1.97 g's	12.17 g's	5.75 In/s	26 mS		2
○	3	228. mS	-0.77 g's	-16.08 g's	32.49 In/s	26 mS		2
○	R	228. mS	2.35 g's	19.77 g's	71.48 In/s	26 mS		2

PEAK G RESULTANT: 20 Gs. PEAK G(Z): 16 Gs. 200 Hz filter.

ACCELEROMETER OUTPUT: Ch1 = X(vert.); Ch2 = Y(long.); Ch3 = Z(trans.)
Ch4 = Resultant.
Aft side = desiccant port end.
Ambient temperature _humidity.
ASTM D 4169, ASTM D 6179. SAE ARP1967.

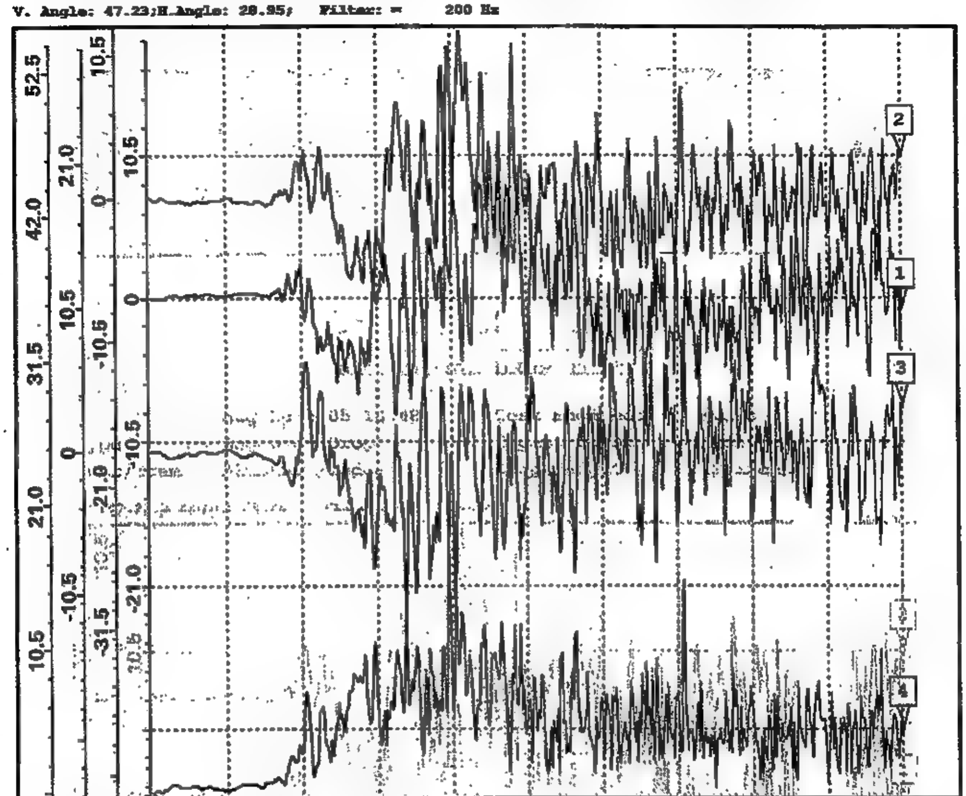
GRAPH 8

B-52 RADOME

ROTATIONAL DROP TEST

	Aug 18 2005 14:48	Test Engineer :	Evans
Test type :	Edgewise Drop	Impact Point :	Right edge
Container/Item:	Aluminum/radome	Drop Height :	12 inches

V. Angle: 47.23;H.Angle: 28.85; Filter: = 200 Hz



	Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
○	1	237. mS	1.92 g's	18.63 g's	5.29 In/s	26 mS	1	2
●	2	237. mS	1.81 g's	12.58 g's	-0.06 In/s	26 mS	1	2
○	3	237. mS	1.00 g's	-18.90 g's	-61.18 In/s	26 mS	1	2
○	R	237. mS	2.82 g's	25.07 g's	61.40 In/s	26 mS	1	2

PEAK G RESULTANT: 26 Gs. PEAK G(Z/X): 19 Gs. 200 Hz filter.

ACCELEROMETER OUTPUT: Ch1 = X(vert.); Ch2 = Y(long.); Ch3 = Z(trans.)
Ch4 = Resultant.
Aft side = desiccant port end.
Ambient temperature _humidity.
ASTM D 4169, ASTM D 6179. SAE ARP1967.

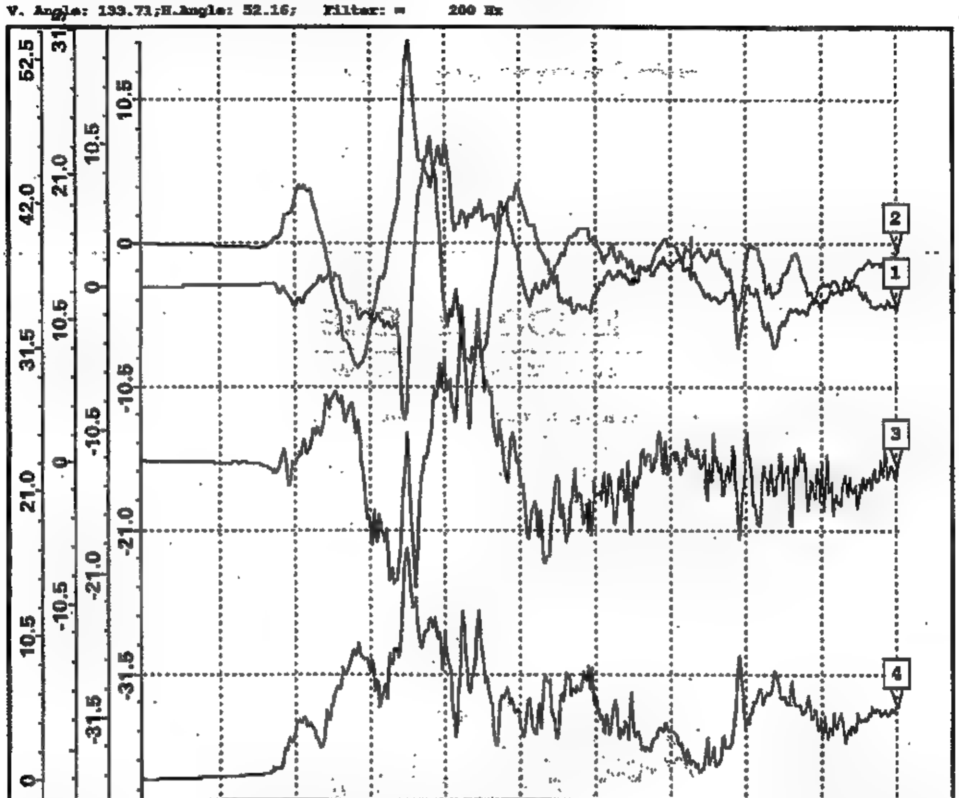
GRAPH 9

B52 RADOME

PENDULUM IMPACT TEST

	Jan 4 2006 12:44	Test Engineer :	Evans
Test type :	Impact	Impact Point :	Foward side
Container/Item:	Aluminum/B52 RADOME	Impact Velocty:	7.3 ft/s

V. Angle: 133.71;H.Angle: 52.16; Filter: = 200 Hz



Ch.	Time		Curr Amp	Peak Amp	1st Int	Time/Div		Hexp	Vexp
1	189.	mS	-0.98 g's	14.72 g's	-3.40 In/s	26	mS	1	2
2	189.	mS	0.63 g's	10.89 g's	38.35 In/s	26	mS	1	2
3	189.	mS	0.81 g's	11.95 g's	-12.42 In/s	26	mS	1	2
R	189.	mS	1.42 g's	16.85 g's	40.45 In/s	26	mS	1	2

PEAK G RESULTANT: 17 Gs. PEAK G(X): 15 Gs.

ACCELEROMETER OUTPUT: Ch1 = X(long.); Ch2 = Y(vert.); Ch3 = Z(trans.)
Ch4 = Resultant.
Aft side = desiccant port end.
Ambient temperature _humidity.
ASTM D 4169, ASTM D 6179. SAE ARP1967. Accel S/N 16471

APPENDIX 3

FIGURES

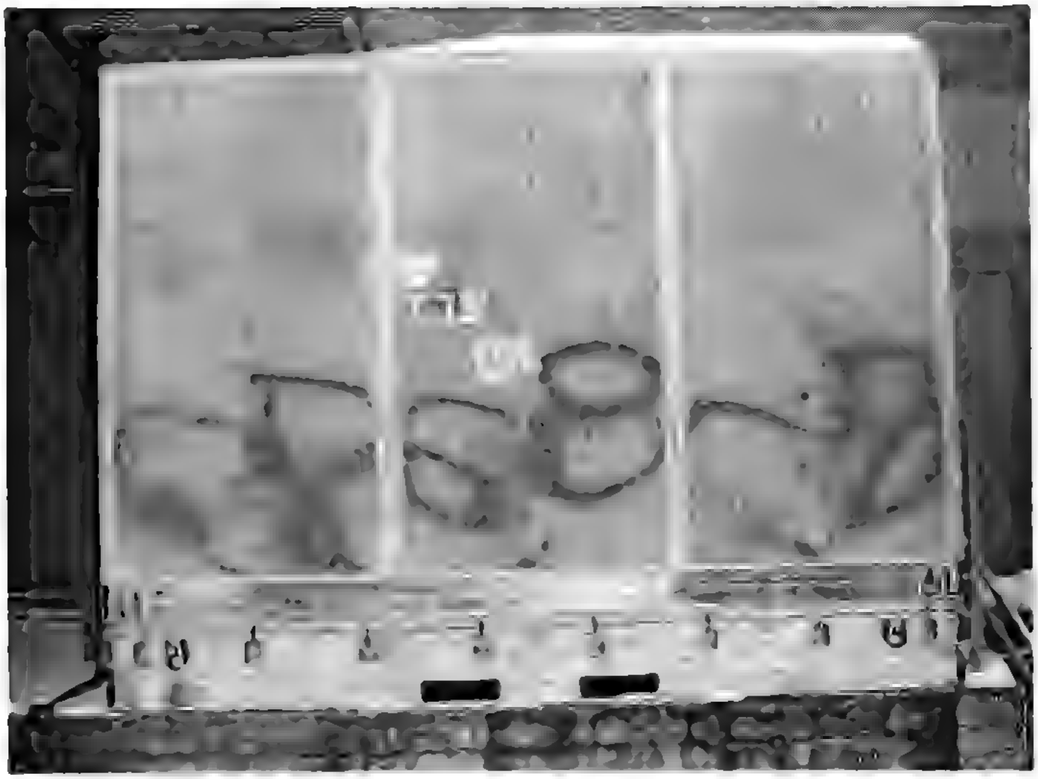


Figure 1. B-52 Nose Radome Container (Side View)

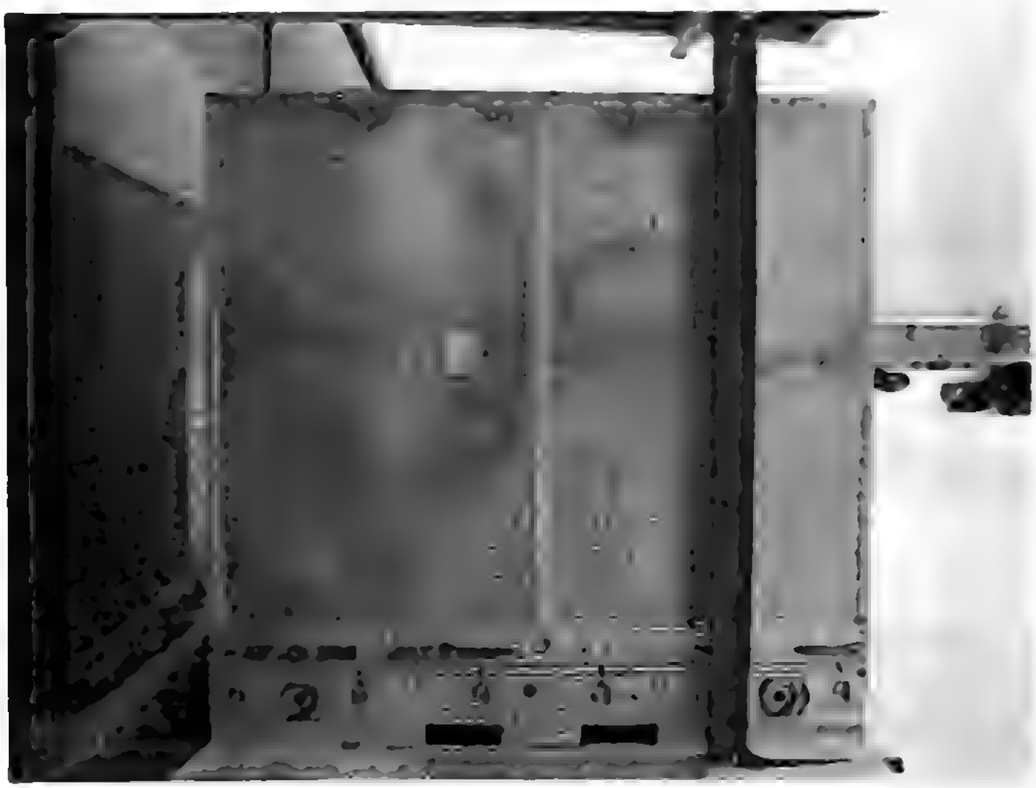


Figure 2. B-52 Nose Radome Container (End View)

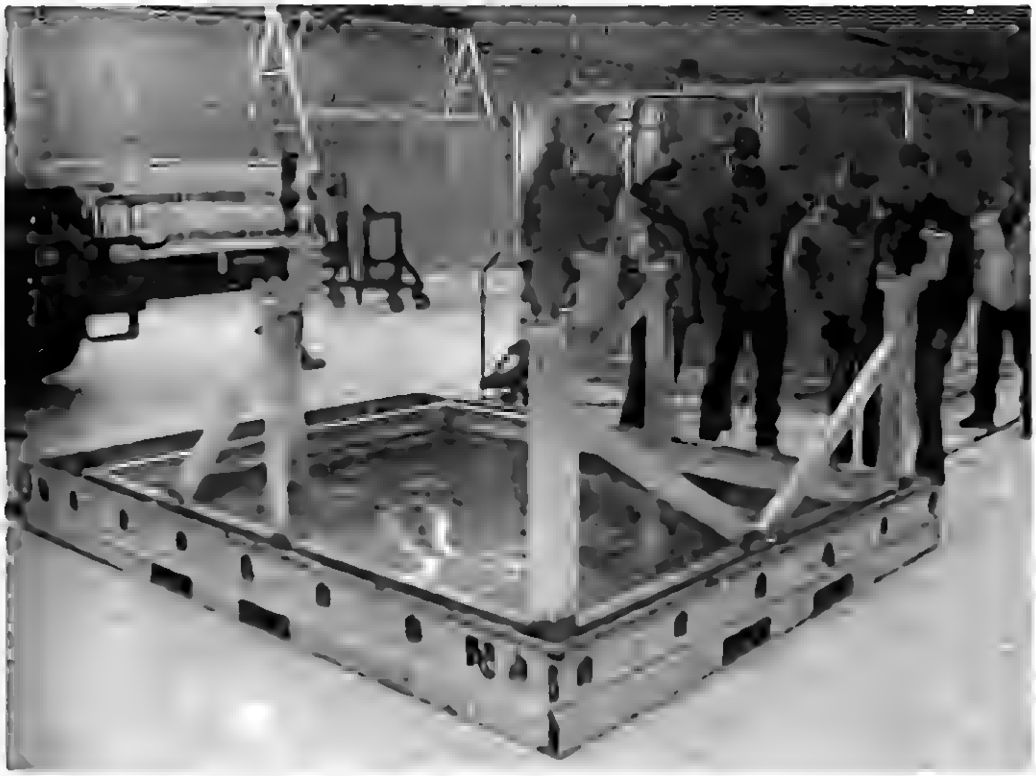


Figure 3. Container Interior

Figure 4. B-52 Nose Radome with Lifting Frame attached in transport trailer

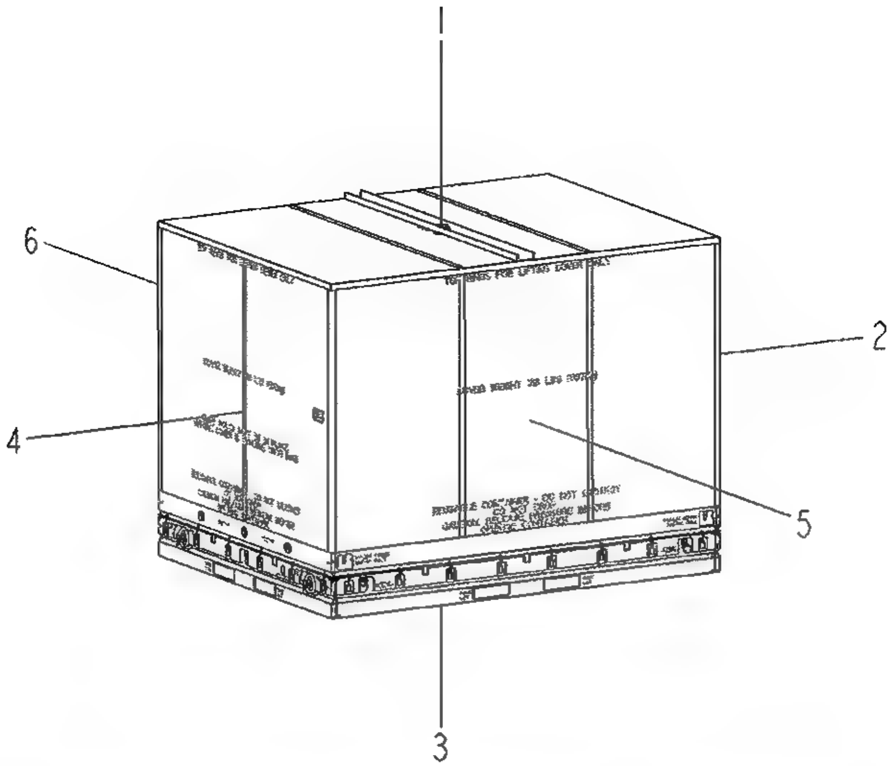


Figure 5. Container Side Designations

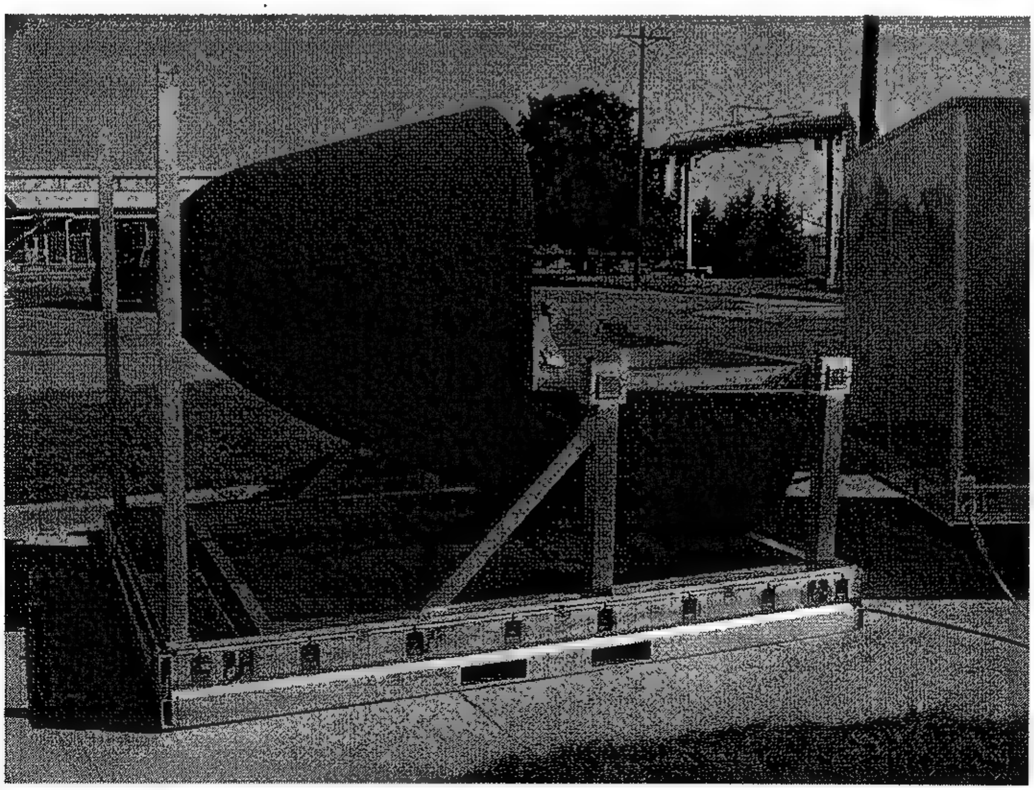


Figure 6. B-52 Nose Radome in Container Base

Figure 7. Container Weight

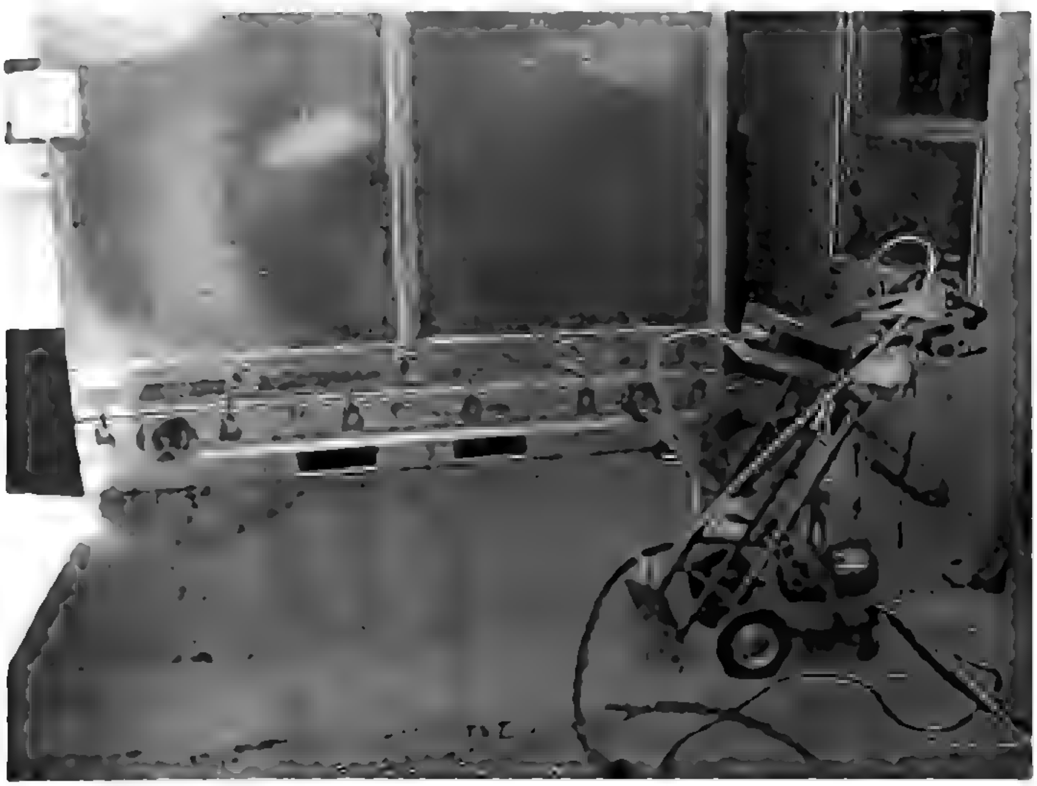


Figure 8. Pneumatic Pressure Leak Test

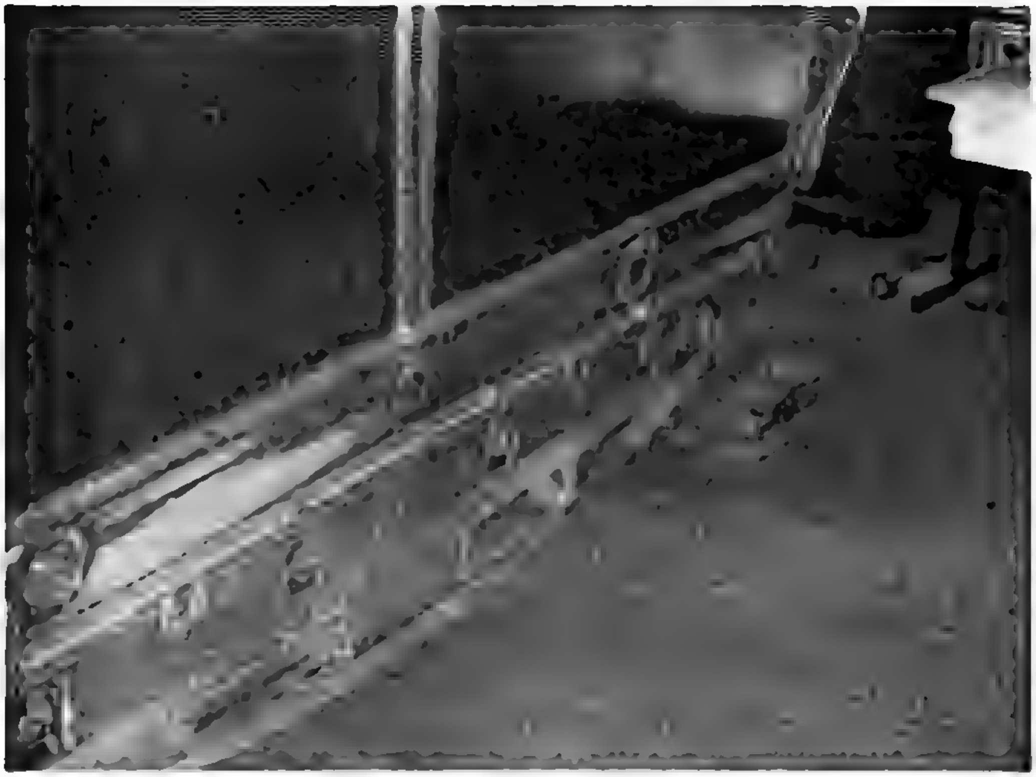


Figure 9. Cornerwise-Drop Test

Figure 10. Edgewise-Drop Test

Figure 11. Pendulum-Impact Test

Figure 12. Over-the-Road Vehicle Vibration Test

APPENDIX 4

DISTRIBUTION LIST

DISTRIBUTION LIST

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DEFENSE TECHNICAL INFORMATION CENTER
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WRIGHT-PATTERSON AFB OH 45433-5540

OC-ALC/GBMSTP
TINKER AFB OK 73145-5000

OO-ALC/LGMPD
HILL AFB UT 84056-5000

WR-ALC/LGMTP
ROBINS AFB GA 31098-5000

OC-ALC/MNBDA
TINKER AFB OK 73145-5000

HQ ACC/A4A52
TINKER AFB OK 73145-3021

327 BMSG/LR
TINKER AFB OK 73145-3021

APPENDIX 5

REPORT DOCUMENTATION

REPORT DOCUMENTATION PAGE	*Form Approved* *OMB No. 0704-0188*

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

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1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
30-01-06	Final	Sep 2004 - Jan 2006

4. TITLE AND SUBTITLE	
Development of the B-52 Nose Radome Container, CNU-680/E	5a. CONTRACT NUMBER
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER 04-P-111
Joel A. Sullivan Susan J. Evans	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
HQ AFMC/LSO/LOP 5215 Thurlow St. Wright-Patterson AFB, OH 45433-5440	06-R-01

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
327 BMSG/LR 3001 Staff Dr. Suite, 2AG 192B Tinker AFB, OK 73145-3021	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release
Distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

This report is responsible for documenting the design and qualification testing of the CNU-680/E container. The container developed will protect the Nose Radome mechanically, environmentally, and make the item much more easy to maneuver during worldwide shipment and storage. The CNU-680/E, designed per ARP1967A, is an aluminum, long life, controlled breathing, reusable container. The container passed all qualification tests ASTM D4169 as well as field tests. The CNU-680/E container will not only meet the users' requirements but will also provide an economic savings in O&M costs. The CNU-680/E container was designed, prototyped and tested in house at the Air Force Packaging Technology & Engineering Facility and is qualified for production release.

15. SUBJECT TERMS

CNU-680/E, B-52 Nose Radome, Aluminum Container, Reusable Container, Long-Life Container

16. SECURITY CLASSIFICATION OF: a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
					Joel A. Sullivan
U	U	U	UU	45	19b. TELEPHONE NUMBER *(Include area code)* (937) 257-8162

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